

GRS & Segmental Block Walls



Larry Jones
Asst. State Structures Design Engineer
& State Geotechnical Engineer

Outline

- ◆ GRS Abutments / SBW MSE Retaining Walls
- ◆ Invitation to Innovation
- ◆ Structures Manual
- ◆ Design Guidance
- ◆ Plans Information
- ◆ Specifications

GRS - Invitation to Innovation

The screenshot shows the FDOT website with the following elements:

- Header:** FDOT logo, Florida Department of TRANSPORTATION, E-Updates | FL511 | Mobile | Site Map, and a search bar.
- Navigation:** Home, About FDOT, Contact Us, Maps & Data, Offices, Performance, Projects.
- Main Image:** A large bridge at sunset.
- Section: In the Blink of an Eye**

A recent documentary captures the story of the Mathews Bridge repair following a major collision with a ship. The emergency repairs to the Jacksonville landmark took place in late 2013. [More...](#)

1 2 3 4 5
- Travelers and Commuters**

511, SunPass, Road Conditions, Rest Areas, Service Plazas, More...
- Business and Government**

Bid Letting/Awards, Contracts, Permits, Planning, Programs, Specifications, More...
- Newsroom**


Media Contacts, News Releases, Photos, Social Media, Videos, More...
- Public Involvement**
 - Meetings
 - [Executive Meetings](#)
 - [Florida Administrative Register](#)
 - [Florida Transportation Commission](#)
 - [Public Notices](#)
 - Project Information**
 - [Active Projects](#)
 - [Future Projects](#)
 - [Florida Traveler's Guide](#)
 - [Future Plans and Studies](#)
- Tools and Resources**
 - [Facilities Map](#)
 - [SunPass Program](#)
 - [Florida Traffic Info](#)
 - [Basis of Estimates](#)
 - [Contracts Administration](#)
 - [Design Standards](#)
 - [Florida UCP DBE Directory](#)
 - [Plans Preparation Manual](#)
- Small Business**

[View All Florida Initiatives](#)
- Procurement**
 - [Procurement Advertisements](#)
 - [Project Letting Information](#)
 - [Small Business](#)
 - [Specifications](#)
 - [Straight-Line Diagrams](#)

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Florida Department of Transportation
Consistent, Predictable, Repeatable

GRS - Invitation to Innovation

**Florida Department of
TRANSPORTATION**

E-Updates | FL511 | Mobile | Site Map


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Agency Resources

Agency Resources / Florida Initiatives


Florida Initiatives

**IT'S YOUR MONEY
TAX CUT BUDGET**


It's Your Money Tax Cut Budget
Our executive budget for 2014-2015, the "It's Your Money Tax Cut Budget," reflects our commitment to give \$500 million back to Florida families through tax and fee cuts, eliminate government waste and pay down debt. These are the three steps in our formula to create jobs for generations to come. This budget will continue to drive the economic turnaround our state has made over the last three years as we build on policies to keep Florida working. To learn more, visit www.FLitsYourMoney.com.

**EMPLOY FLORIDA
HELP FINDING A JOB**


Employ Florida
The Employ Florida Marketplace is your one-stop online resource for job listings, education and training opportunities, career building assistance and much more. As an employer, the Employ Florida Marketplace offers a multitude of resources to help you find the perfect candidate, create job listings, review job market trends and more. To learn more, visit <https://www.employflorida.com/>.

**Florida Department of Transportation
DASHBOARD**


FDOT Performance Dashboard
The Performance Dashboard is a management tool that helps to create organizational effectiveness through an engaged and accountable workforce. To learn more, visit <http://www3.dot.state.fl.us/performance/dashboard/>.

**FLORIDA HAS A
RIGHT TO KNOW** Holding Government Accountable

Florida Has a Right to Know
As the Jobs Governor, Governor Scott is working to make Florida the best place to work, live, and play. He is changing how Florida does business by eliminating burdensome regulation, reducing state spending, cutting taxes and holding government accountable. To learn more, visit <http://www.floridahasarighttoknow.com/>.

**INVITATION TO
INNOVATION**

Invitation to Innovation
Recently, the Department embarked into a new bold era for innovative ideas, research and accelerated implementation. Success in this new era depends on the ability to innovate the products and services Florida's transportation system provides its users. The Florida Department of Transportation's desire for innovation will utilize newly developed technology or employ "outside the box" thinking to generate new and better value for every transportation dollar invested. To learn more, visit <http://www.dot.state.fl.us/officeofdesign/innovation/>.

**Open Government**
The Florida Department of Transportation is committed to the

GRS - Invitation to Innovation

Office of Design

Office of Design / Invitation to Innovation

Invitation to Innovation

Office of Design

Florida's Transportation Engineers

INVITATION TO INNOVATION



Recently, the Department embarked into a new bold era for innovative ideas, research and accelerated implementation. Success in this new era depends on the ability to innovate the products and services Florida's transportation system provides its users. The Florida Department of Transportation's desire for innovation will utilize newly developed technology or employ "outside the box" thinking to generate new and better value for every transportation dollar invested.

After researching and evaluating many innovative ideas, the Central Office has developed a list of concepts, products and services that may be the best solution to the project's needs or design challenges. Some items on the list are completely developed, and only need tailoring to your project. We encourage you to propose one or more of these innovations for project specific solutions with confidence of approval by the Districts. Other items are not fully detailed and will require coordination with and approval by the District's Design Office. Many of these innovations have been successfully implemented in other states and countries. Not all projects benefit from these innovations and the Department is not advocating the general use of new products or designs where an economical well proven solution exists and is the most appropriate solution for the situation.

Please consider these innovations as possible solutions to your project-specific needs. We invite you to review innovations listed in the links below. Additional innovations will be added as they are identified and developed. If you have any questions, details and contact information are included within the information for each innovation web site.

Structures Design Office

Prefabricated Bridge Elements and Systems
Curved Precast Spliced U-Girder Bridges
Geosynthetic Reinforced Soil Integrated Bridge System
Geosynthetic Reinforced Soil Wall
Segmental Block Walls

Engineering CADD Office

Coming Soon

Roadway Design Office

Roundabouts - Proven Safety Countermeasure
Diverging Diamond Interchange/Double Crossover Intersection

Surveying and Mapping Office

CADD/GIS Interoperability

QPL Office

Coming Soon

GRS - Invitation to Innovation

The screenshot displays the FDOT website page for Geosynthetic Reinforced Soil Integrated Bridge System (GRS-IBS). The browser address bar shows the URL: <http://www.dot.state.fl.us/structures/innovation/GRS-IBS.shtm>. The page features a left-hand navigation menu with sections like 'Main Level Navigation', 'Information By Topic', 'Meetings/Events', 'Offices', 'Office Level Navigation', 'Main Page', 'General', 'Job Opportunities', 'Building', 'Publications', 'Archives', 'Software', 'Structures Research', 'Miscellaneous', and 'FDOT Facilities'. The main content area is titled 'Geosynthetic Reinforced Soil Integrated Bridge System (GRS-IBS)' and includes an 'Overview' section, 'Informational Photos and Videos', 'Design Criteria', 'Specifications', 'Implementation Plan', 'Usage Restrictions / Parameters', and 'Contact Information'. A red box highlights the 'Design Criteria' section, which states: 'FDOT Design Requirements are provided in [Structures Design Bulletin 12-06](#).' The 'Photo Slideshow' on the right shows a bridge under construction. The 'Contact Information' section lists Larry Jones, Asst. State Structures Design Engineer & State Geotechnical Engineer, with phone (850) 414-4305 and email larry.jones@dot.state.fl.us.

GRS - Invitation to Innovation

The screenshot displays the FDOT website at <http://www.dot.state.fl.us/structures/innovation/GRS-IBS.shtm>. The page is titled "Geosynthetic Reinforced Soil Integrated Bridge System (GRS-IBS)" and is categorized under "Structures Design - Transportation Innovation".

Navigation Menus:

- Home | Business Partners | Employment | Programs | Projects | Related Links | Research Statistics | Travel Information
- December 7, 2013
- Main Level Navigation: Information by Topic, Meetings/Events, Offices
- Office Level Navigation: Main Page, General, Job Opportunities, Building, Publications, Archived, Affiliates, Structures Research, Miscellaneous, FDOT Facilities

Photo Slideshow: A photo of a bridge structure is shown with the caption "Photos courtesy of FHWA".

Overview:

GRS abutments are part of FHWA's [Even Day Counts \(EDC\) Initiative](#) to reduce bridge construction time and cost. A limited number of small bridge projects have been constructed in other parts of the country using this technology in combination with precast bridge components. These projects were considered cost effective and are performing well. The lessons learned during those projects led to the FHWA's [GRS Guide](#). Use of GRS abutments and walls on the interstate or major multi-lane highways requires the approval of the State Structures Design Engineer.

GRS abutments are shallow foundations constructed using a combination of gravel and closely spaced layers of geotextile or geogrid. The approach to the bridge is integrated into the GRS abutment in lieu of utilizing an approach slab.

Informational Photos and Videos:

FHWA produced several videos which provide background information and testimonials from Engineers across the country regarding their use of GRS abutments for bridges on public roads. These videos and several additional construction photos are available at the following FHWA website:

http://www.fhwa.dot.gov/evidencerecord/technology/grs_ibs_multimedia.cfm

FHWA's construction [demonstration video](#) is also available on YouTube.

Design Criteria:

FDOT Design Specifications are provided in [Workshops, Revision Bulletin 13-06](#).

Developmental Design Standard

[Developmental Design Standard D6025](#) is available for presenting details in the project plans. This Developmental Standard includes details for wrap-around abutments and details for the transition between the roadway/guardrail and the bridge railing. Please review the [Developmental Design Standards Policy](#) prior to requesting D6025.

Specifications:

Construct GRS abutments and wing walls in accordance with [Developmental Specification 549](#).

Implementation Plan:

With the exception of interstate or major multi-lane highway applications, GRS abutments may be utilized, when appropriate and cost effective, on all FDOT projects. Use of GRS abutments on the interstate or major multi-lane highways requires the approval of the State Structures Design Engineer.

Usage Restrictions / Parameters:

Use of GRS abutments is limited to 1-lane or 2-lane bridges with simply supported end spans of less than 140 feet in length. Abutments are limited to 30 feet in height. The use of GRS abutments on the interstate or major multi-lane highways requires the approval of the State Structures Design Engineer.

Contact Information:

Larry Jones
Asst. State Structures Design Engineer
& State Geotechnical Engineer
Phone: (850) 414-4305
e-mail: larry.jones@dot.state.fl.us

GRS - Invitation to Innovation

The screenshot displays the FDOT website's 'Structures Design - Transportation Innovation' section for Geosynthetic Reinforced Soil Integrated Bridge System (GRS-IBS). The page is organized into several sections:

- Navigation:** Includes a top menu with links like Home, Business Partners, Employment, Programs, Projects, Related Links, Research/Statistics, and Travel Information. A left sidebar contains a 'Main Level Navigation' menu with links to Information By Topic, Meetings/Events, Contacts, and Office Level Navigation.
- Overview:** Provides a brief introduction to GRS-IBS, stating it is a part of FHWA's 'Even Day Counts' (EDC) initiative to reduce bridge construction time and cost. It mentions that GRS-IBS is commonly referred to as GRS Abutments.
- Informational Photos and Videos:** Features a 'Photo Slideshow' on the right side of the page, showing a bridge under construction. Below the slideshow, it states 'Photos courtesy of FHWA' and includes a 'Play' button for a video.
- Design Criteria:** Mentions that FDOT Design Requirements are provided in 'Structures Design Bulletin 12-06'.
- Developmental Design Standard:** States that 'Developmental Design Standard D6022' is available for presenting details in the project plans. It includes a link to the 'Developmental Design Standard Policy'.
- Specifications:** This section is highlighted with a red box. It states: 'Construct GRS abutments and wing walls in accordance with [Developmental Specification 549](#)'.
- Implementation Plan:** Explains that with the exception of interstate or major multi-lane highway applications, GRS abutments may be utilized, when appropriate and cost effective, on all FDOT projects. It notes that use of GRS abutments on the interstate or major multi-lane highways requires the approval of the State Structures Design Engineer.
- Usage Restrictions / Parameters:** Specifies that the use of GRS abutments is limited to 1-lane or 2-lane bridges with simply supported end spans of less than 140 feet in length. It also mentions that abutments are limited to 30 feet in height and that use of GRS abutments on the interstate or major multi-lane highways requires the approval of the State Structures Design Engineer.
- Contact Information:** Lists Larry Jones as the Asst. State Structures Design Engineer & State Geotechnical Engineer, with contact details: Phone: (850) 414-4305, e-mail: Larry.Jones@dot.state.fl.us.

GRS - Structures Manual Volume 1

Structures Design Guidelines

3 - Substructure, Retaining Walls and Noise Walls

Topic No. 625-020-018

January 2014

3.12.12 Geosynthetic Reinforced Soil (GRS) Walls and Abutments

- A. GRS abutments are a shallow foundation and retaining wall option that may significantly reduce the construction time and cost of single span bridges.
- B. GRS walls and abutments, like MSE walls, are very adaptable to both cut and fill conditions and can tolerate a greater degree of differential settlement than CIP walls. GRS walls, however, are also not appropriate for all sites.

Commentary: The use of GRS walls and abutments may be precluded because of insufficient room to place the soil reinforcement, poor insitu soils, locations with excessive stream flow or wave action, etc.

- C. GRS walls and abutments are constructed with coarse aggregate or Graded Aggregate Base (GAB) backfill and geosynthetic soil reinforcement.
- D. GRS-Integrated Bridge System bridge abutments generally consist of the following:
 - 1. 4000 psi Concrete Masonry Unit (CMU) facing blocks
 - 2. Geosynthetic reinforcement with ultimate tensile strength $\geq 4,800$ lb/ft.

GRS - Structures Manual Volume 1

- 3. Geosynthetic reinforcement spacings of less than 12 inches with smaller spacings in different portions of the GRS abutment.
- 4. GRS backfill may consist of coarse aggregate or GAB.
- E. Use of GRS walls and abutments on the Interstate or on other highways with abutments carrying 2 or more lanes in a single direction or 4 or more lanes in two directions requires the approval of the State Structures Design Engineer. Their use will typically be restricted and not approved for use on water crossings subject to stream flow in excess of 9 ft/sec, or locations with sufficient wave action to displace scour countermeasures.

Modification for Non-Conventional Projects:

Delete **SDG** 3.12.12.E and insert the following:

- E. GRS is not allowed for abutments on the Interstate or on other highways with abutments carrying 2 or more lanes in a single direction or 4 or more lanes in two directions, unless specifically stated in the RFP.

- F. GRS details are shown in the plans using Developmental Design Standard D6025.

GRS - Design Guidance

- FHWA GRS-IBS Interim Implementation Guide
- Appendix C – LRFD Design
- FDOT Structures Design Guidelines

Geosynthetic Reinforced Soil Integrated Bridge System Interim Implementation Guide

PUBLICATION NO. FHWA-HRT-11-026

JANUARY 2011



U.S. Department of Transportation
Federal Highway Administration

Research, Development, and Technology
Turner-Fairbank Highway Research Center
6300 Georgetown Pike
McLean, VA 22101-2296


GRS - Plans Information

- ◆ Developmental Design Standard D6025
 - ✓ Uniformity in GRS Plans
 - ✓ Remove Designer's Uncertainty
 - ✓ Simplify Fee Negotiations
 - ✓ Reduce Design Costs

GRS - Plans Information

The screenshot displays the FDOT website at <http://www.dot.state.fl.us/structures/innovation/GRS-IBS.shtm>. The page is titled "Geosynthetic Reinforced Soil Integrated Bridge System (GRS-IBS)" and is commonly referred to as GRS Abutments. The left sidebar contains various navigation links, including "Main Level Navigation", "Information By Topic", "Meetings/Events", "Offices", "Office Level Navigation", "Main Page", "General", "Job Opportunities", "Buildings", "Publications", "Standards", "Software", "Structures Research", "Miscellaneous", and "FDOT Facilities". The main content area includes a "Photo Slideshow" showing a bridge over a river, an "Overview" section describing GRS abutments as part of FHWA's EDC Initiative, "Informational Photos and Videos" section, "Design Criteria" section, and "Specifications" section. A red box highlights the "Developmental Design Standard" section, which states: "Developmental Design Standard D602S is available for presenting details in the project plans. This Developmental Standard includes details for wrap-around abutments and details for the transition between the roadway/guardrail and the bridge railing. Please review the [Developmental Design Standards Policy](#) prior to requesting D602S." The page also includes contact information for Larry Jones, Asst. State Structures Design Engineer & State Geotechnical Engineer.

GRS - Plans Information



**Florida Department of
TRANSPORTATION**

[E-Updates](#) | [FL511](#) | [Mobile](#) | [Site Map](#)

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Office of Design
 Office of Design / Design Standards / Developmental Design Standards
Developmental Design Standards

Developmental Design Standards (DDS) are to be released by the appropriate section within the Office of Design to implement new technologies in a limited trial fashion on an as-needed or an as-available basis. As a *DDS* is released, a *Design Bulletin* will be issued to announce its availability.

Designers wishing to use a *DDS* must follow the *Developmental Design Standards Usage Process* which is posted in the link provided below.

Plans reviewers must verify each *DDS*, included in a plan set is permitted for the use by confirming the project's FPID number which is listed with the appropriate *DDS* below.

START HERE
➡
Developmental Design Standards Usage Process
for Design-Bid-Build Projects
➡
START HERE

Developmental Design Standard (PDF)	Title	Monitor Contact	Instructions (PDF)	Data Tables (ZIP)	Developmental Specifications (N/A-Spec#)
* TRAFFIC RAILINGS *					
D477	Three-Beam Panel Retrofit (Concrete Handrail) (NOTE***Migrated to the <i>Design Standards</i> effective for lettings beginning January 2014; See Index 477 in the current <i>Design Standards</i> <i>eBooklet</i>) Permitted Projects FPID No(s): 423064-1-52-01	Steve Nolan			N/A
* GENERAL *					
D591 Certification Statement	Landscape Irrigation Sleeves Permitted Projects FPID No(s):	Jeff Caster			N/A
D6025 Certification Statement	GRS-IBS Permitted Projects FPID No(s): 430469-1	Larry Jones	IDD S-D6025	CEL-D6025	Dev549
* TRAFFIC SIGNAL AND EQUIPMENT *					
D17749	Damping Device for Miscellaneous Structures	Steve Nolan	IDD S-D17749		N/A

GRS - DDS D6025

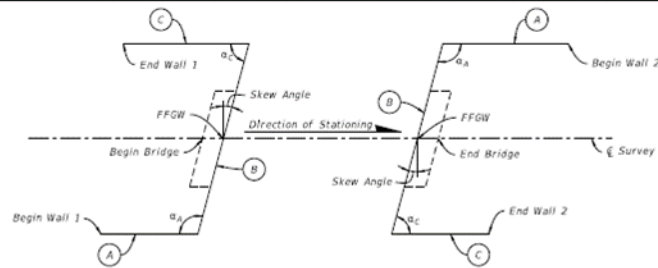
GENERAL NOTES

CONSTRUCTION SPECIFICATIONS:

Florida Department of Transportation "Standard Specifications for Road and Bridge Construction", Current Edition and Supplements as amended. Construct GRS abutments and walls in accordance with Specification 549.

DESIGN SPECIFICATIONS:

Geosynthetic Reinforced Soil Integrated Bridge System Interim Implementation Guide, FHWA-HRT-11-026, January 2011 except as amended by the FDOT Structures Manual (current edition).



WALL LABELING DIAGRAM

DEFINITION OF VARIABLES

- a_b = Set back distance between back of facing element and beam seat
- B = Base length of reinforcement
- b = Bearing width for bridge beam seat
- B_f = Length of bearing bed reinforcement
- B_{RSF} = Width of RSF
- d_b = Depth of beam seat
- d_s = Clear space from top of wall to bottom of superstructure
- D_f = Depth of bearing bed
- D_{RSF} = Depth of RSF below bottom of wall elevation
- D_{12} = Depth of GRS-GAB transition
- h_{13} = Height of road base (equals height of superstructure and pavement thickness)
- H = GRS Design Height
- L = Length of GRS Backfill Reinforcement
- L_b = Abutment width
- L_p, L_c = Wingwall length
- S = Minimum distance from guardrail $\&$ to back of CMU
- X_{RSF} = Width of RSF in front of the abutment and wingwall wall face
- α_w, α_c = Wingwall angle

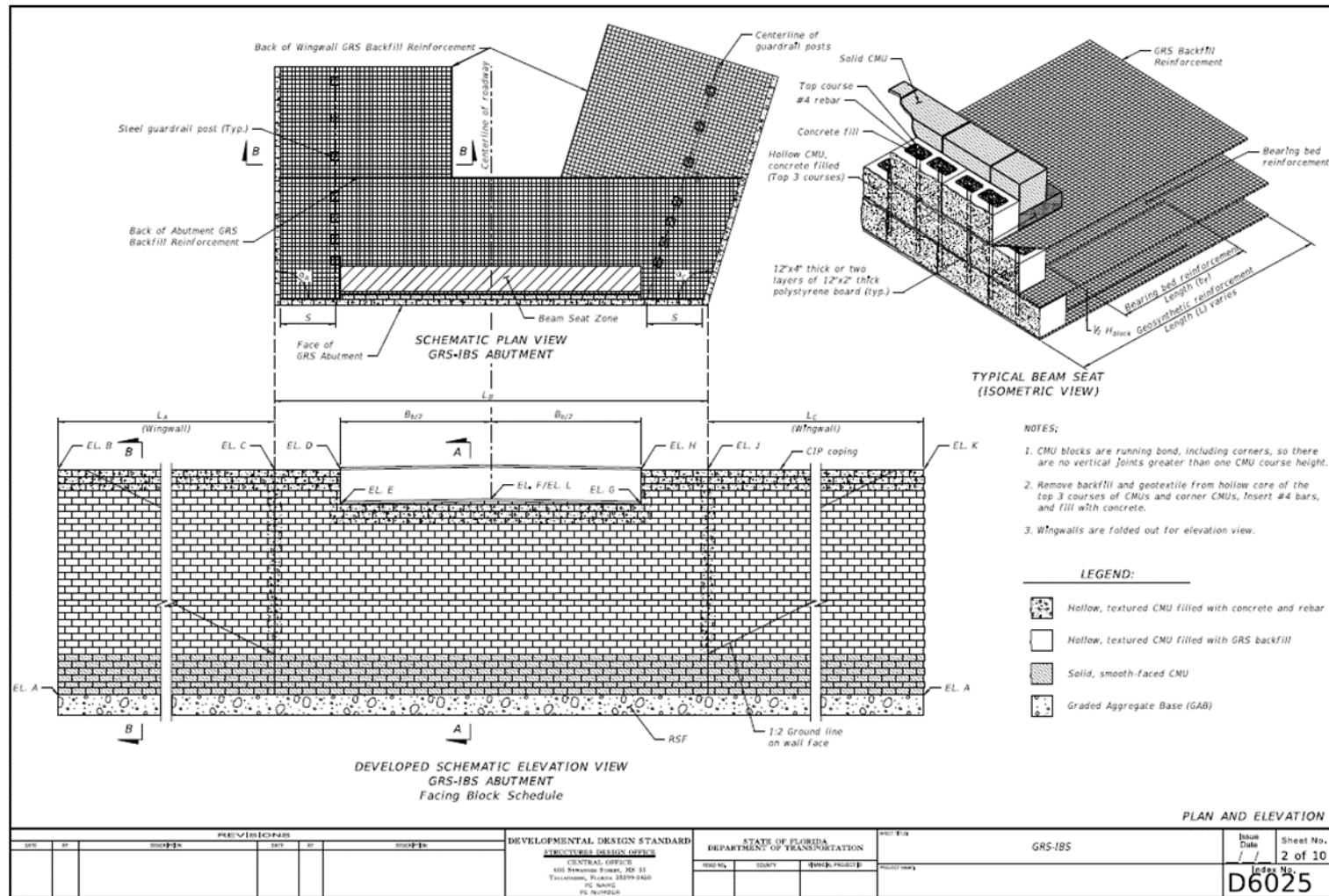
ABBREVIATIONS

- AOS = Apparent Opening Size
- B_0 = Width of the bridge
- B_{block} = Width of CMU = 7½"
- CMU = Concrete masonry unit
- d_{max} = Maximum particle diameter in GRS backfill
- FFGW = Front Face of GRS Wall
- GAB = Graded Aggregate Base
- GRS = Geosynthetic Reinforced Soil
- H_{block} = Height of CMU = 7½"
- IBS = Integrated Bridge System
- L = Length of GRS Backfill Reinforcement
- L_{block} = Length of CMU = 15½"
- RSF = Reinforced soil foundation
- T_{ult} = Design Standards Index 501 Ultimate Tensile Strength
- $T_{2\%}$ = Design Standards Index 501 2% Strain Tensile Strength

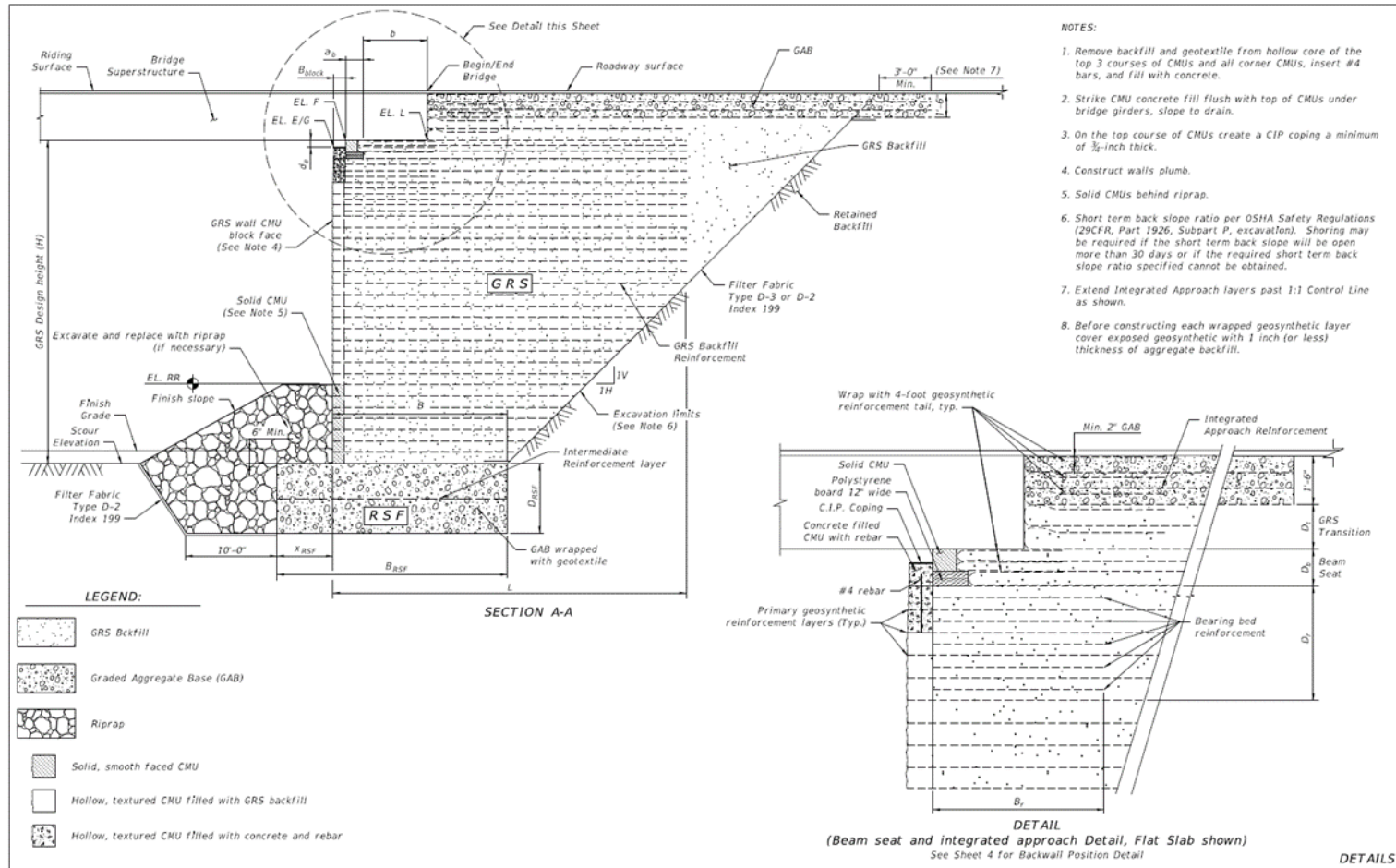
GENERAL NOTES

PREVIOUS EDITION						DEVELOPMENTAL DESIGN STANDARD	STATE OF FLORIDA DEPARTMENT OF TRANSPORTATION			PROJECT	GRS-185	Issue Date / /	Sheet No. 1 of 10
DATE	BY	DESCRIPTION	DATE	BY	DESCRIPTION		ROAD NO.	COUNTY	PROJECT				
					STRUCTURE DESIGN OFFICE CENTRAL OFFICE 405 Brevard Street, RM 11 Tallahassee, Florida 32399-5400 PG. NAME PG. NUMBER								
												66025	

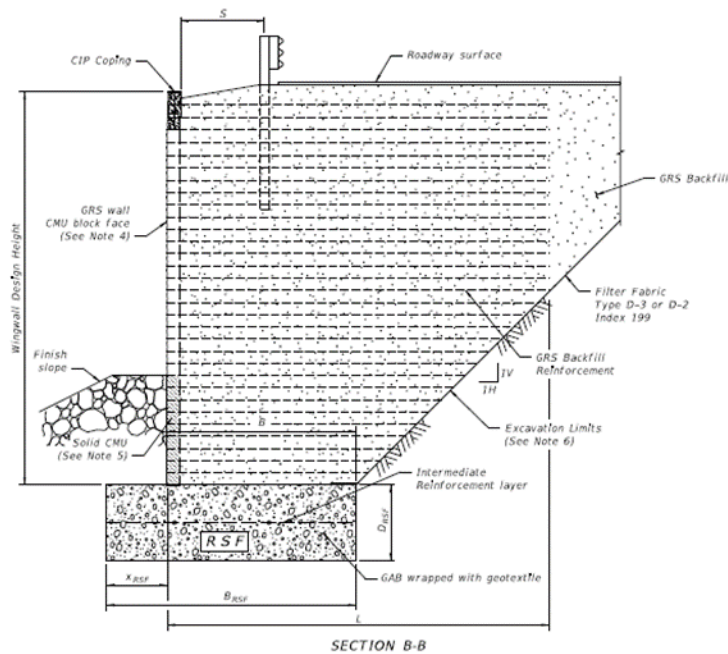
GRS - DDS D6025



GRS - DDS D6025



GRS - DDS D6025



Cross References:
See Sheet 3 for Notes.

REVISIONS						DETAILS			
REV	BY	DESCRIPTION	DATE	BY	DESCRIPTION	STATE OF FLORIDA DEPARTMENT OF TRANSPORTATION	PROJECT NO.	ISSUE DATE	SHEET NO.
						GRS-IBS			4 of 10
DEVELOPMENTAL DESIGN STANDARD						STRUCTURES DESIGN OFFICE	PROJECT NAME	Index No.	
						CENTRAL OFFICE 400 UNIVERSITY BLVD., RD. 35 TALLAHASSEE, FLORIDA 32399-3440 P.O. BOX 100 P.O. TALLAHASSEE		D6025	

GRS - DDS D6025

Instructions for Developmental Design Standards
Index D6025 GRS-IBS

Topic No. 625-010-003-i
July 2012

GRS-IBS DESIGN DIMENSIONS										Table Date 03-30-12
LOCATION				WALL GEOMETRY						
WALL NO.	FFOW (Station)	BEGIN/END BRIDGE (Station)	SKEW ANGLE	L ₁	α ₁	L ₂	α ₂	L ₃	S	
			(FT)	(Deg)	(FT)	(Deg)	(FT)	(FT)	(FT)	
1										
2										

Note to Designer:
The Geotechnical Engineer shall provide the values within the red boxes designated below in a signed and sealed report to the Structural Engineer.

GRS-IBS DESIGN DIMENSIONS															Table Date 03-30-12					
RSF				GRS			BEARING BED			BEAM SEAT				GRS TRANSITION						
WALL NO.	X _{RSF}	Y _{RSF}	D _{RSF}	INTERMEDIATE REINFORCEMENT VERTICAL SPACING	H	B	L	LAYER THICKNESS	B ₁	D ₁	NO. OF INTERMEDIATE REINF. LAYERS	LAYER THICKNESS	α ₁	α ₂	α ₃	NO. OF LAYERS	LAYER THICKNESS	D ₁	NO. OF LAYERS	LAYER THICKNESS
	(FT)	(FT)	(FT)		(FT)	(FT)	(FT)	(IN)	(FT)	(FT)		(IN)	(IN)	(FT)	(IN)	(FT)	(IN)	(FT)	(IN)	(IN)
1																				
2																				

TABLE OF ELEVATIONS													Table Date 03-30-12	
WALL NO.	EL. A	EL. B	EL. C	EL. D	EL. E	EL. F	EL. G	EL. H	EL. J	EL. K	EL. L	EL. RR	Scour Elev.	Finish Grade Elev.
1														
2														

GRS-IBS QUANTITIES ⁽¹⁾			
WALL NO.	GRS BACKFILL (CU YD)	RSF FILL (CU YD)	GRADED AGGREGATE (CU YD)
1			
2			

(1) The estimated materials quantities correspond to the dimensions on the accompanying plan sheets. Deviation from the dimensions on the plan sheets will void the quantities.

CMU COLORS:
Hollow, textured CMU = _____ (color # / none)
Solid, smooth-faced CMU = BTCK Red

CMU TEXTURE:
For hollow, textured CMU, provide Split Face texture.

SCOUR COUNTERMEASURE:
Scour Protection Type: _____
Finish Slope: _____

DESIGN LOADS:
Combined load: Superstructure (qLL + qR) _____ TSF maximum (factored design load).
Roadway live load surcharge = _____ psf uniform vertical.

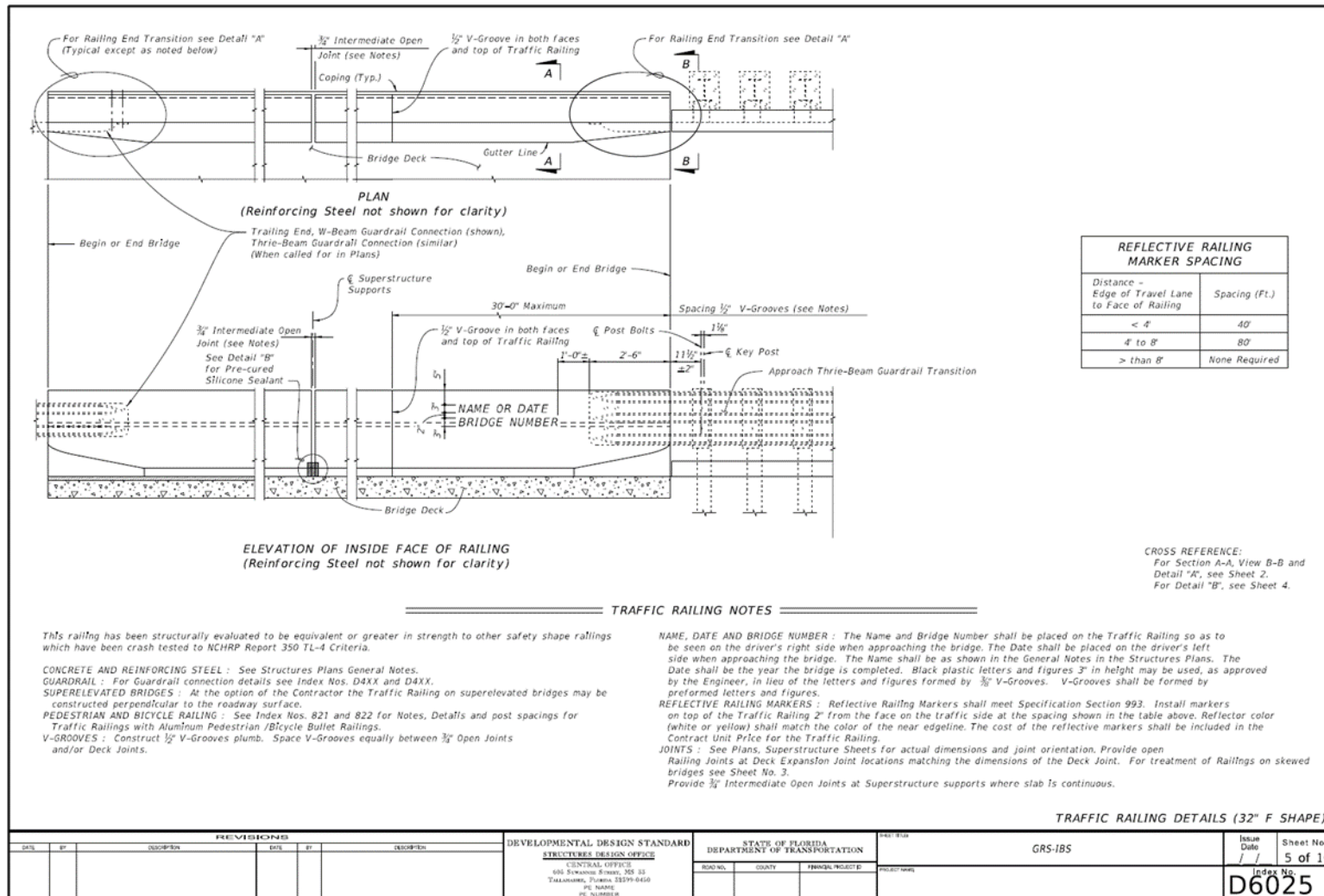
SOIL PROPERTIES:
GAB unit weight = 140 pcf.
GRS backfill: Unit weight = 115 pcf, friction angle = 38°, cohesion = 0 psf
Retained backfill: Unit weight = _____ pcf, friction angle = _____°, cohesion = _____ psf
Foundation soil: Unit weight = _____ pcf (submerged), friction angle = _____°, cohesion = _____ psf

GEOSYNTHETIC REINFORCEMENT:
All Reinforcement:
Use only reinforcement approved for use in Steepened Slopes (Approved Application Usage 1 or 3).
RSF:
Use woven geotextile with a maximum AOS of 0.035 in, and the following minimum strength:
T₉₀ = _____ lb/ft (both machine and cross directions).
All Other Reinforcement:
Use geogrid or woven geotextile having the following minimum strengths:
T₉₀ = _____ lb/ft (both machine and cross directions).
T₂₀ = _____ lb/ft (both machine and cross directions).

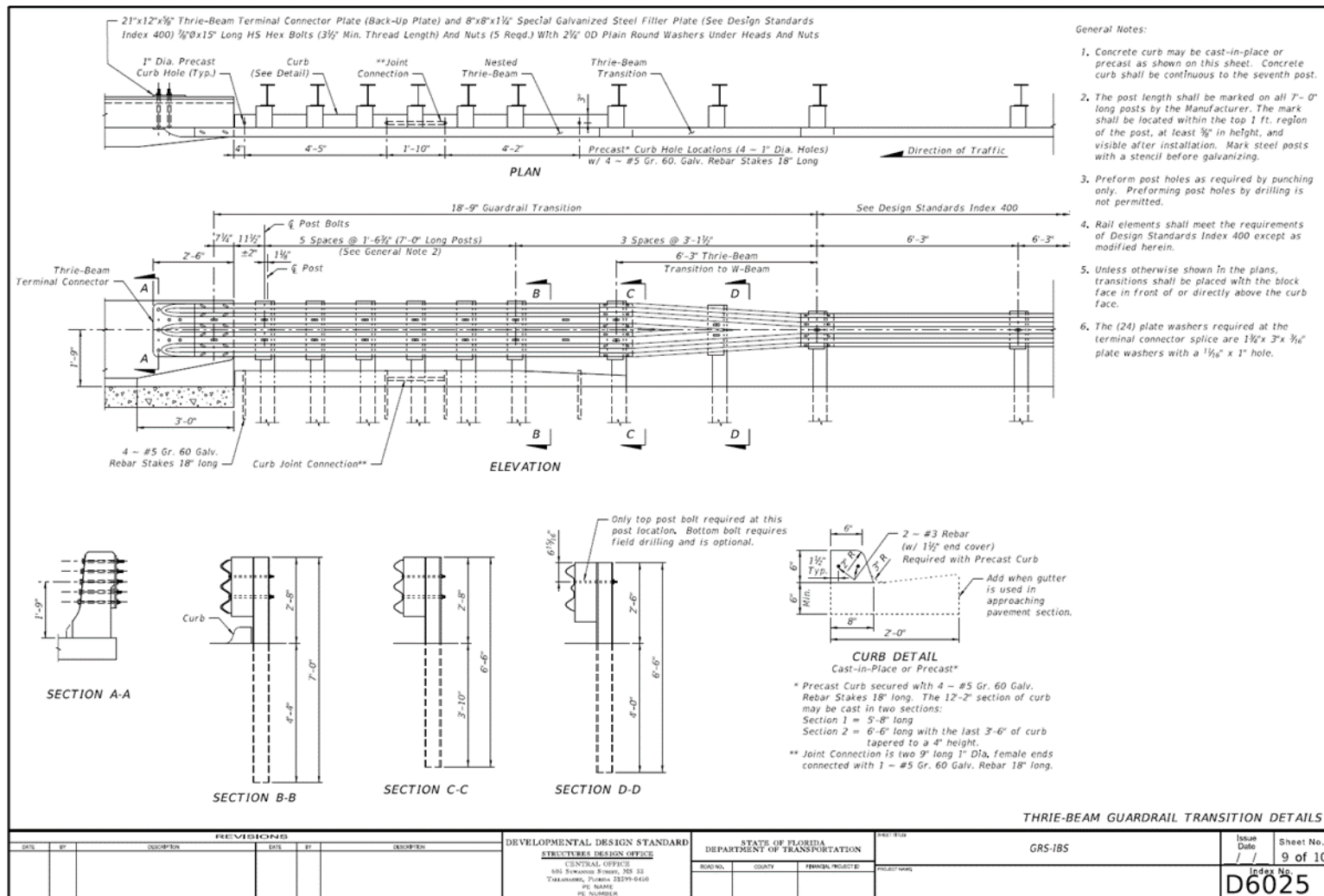
3

2014
Design Training
Expo

GRS - DDS D6025



GRS - DDS D6025



GRS - Specifications

◆ **Developmental Specification 549**

- ✓ Construction Specification for GRS Abutments in FDOT's standard specification format.
- ✓ <http://www.dot.state.fl.us/specificationsoffice/OtherFDOTLinks/Developmental/Files/Dev549.pdf>

GRS - Specifications

The screenshot displays the FDOT website for the Geosynthetic Reinforced Soil Integrated Bridge System (GRS-IBS). The page is titled "Structures Design - Transportation Innovation" and "Geosynthetic Reinforced Soil Integrated Bridge System (GRS-IBS)". It includes a navigation menu on the left with sections like "Main Level Navigation", "Information By Topic", "Meetings/Events", "Offices", and "Office Level Navigation". The main content area features an "Overview" section, "Informational Photos and Videos", "Design Criteria", "Developmental Design Standard", "Specifications", "Implementation Plan", "Usage Restrictions / Parameters", and "Contact Information". A red box highlights the "Specifications" section, which states: "Construct GRS abutments and wing walls in accordance with [Developmental Specification 549](#)". A photo slideshow on the right shows a bridge construction site.

Florida Department Of Transportation

Home | Business Partners | Employment | Programs | Projects | Related Links | Research/Statistics | Travel Information

December 7, 2012

Geosynthetic Reinforced Soil Integrated Bridge System (GRS-IBS)

Commonly referred to as GRS Abutments

Overview

GRS abutments are part of FHWA's [Every Day Counts \(EDC\)](#) initiative to reduce bridge construction time and cost. A limited number of small bridge projects have been constructed in other parts of the country using this technology in combination with precast bridge components. These projects were considered cost effective and are performing well. The lessons learned during those projects led to the FHWA's [GRS Guide](#). Use of GRS abutments and walls on the interstate or major multi-lane highways requires the approval of the State Structures Design Engineer.

GRS abutments are shallow foundations constructed using a combination of gravel and closely spaced layers of geotextile or geogrid. The approach to the bridge is integrated into the GRS abutment in lieu of utilizing an approach slab.

Informational Photos and Videos

FHWA produced several videos which provide background information and testimonials from Engineers across the country regarding their use of GRS abutments for bridges on public roads. These videos and several additional construction photos are available at the following FHWA website:

http://www.fhwa.dot.gov/earth/counts/technologies_grs_bsmultimedia.cfm

FHWA's construction [demonstration video](#) is also available on YouTube.

Design Criteria

FDOT Design Requirements are provided in [Structures Design Bulletin 12-06](#).

Developmental Design Standard

[Developmental Design Standard D6025](#) is available for presenting details in the project plans. This Developmental Standard includes details for wrap-around abutments and details for the transition between the roadway guardrail and the bridge railing. Please review the [Developmental Design Standards Policy](#) prior to requesting D6025.

Specifications

Construct GRS abutments and wing walls in accordance with [Developmental Specification 549](#).

Implementation Plan

With the exception of interstate or major multi-lane highway applications, GRS abutments may be utilized, when appropriate and cost effective, on all FDOT projects. Use of GRS abutments on the interstate or major multi-lane highways requires the approval of the State Structures Design Engineer.

Usage Restrictions / Parameters

Use of GRS abutments is limited to 1-lane or 2-lane bridges with simply supported end spans of less than 140 feet in length. Abutments are limited to 30 feet in height. The use of GRS abutments on the interstate or major multi-lane highways requires the approval of the State Structures Design Engineer.

Contact Information

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GRS - Developmental Specification 549

GEOSYNTHETIC REINFORCED SOIL ABUTMENTS & WALLS.

(REV 12-13-13)

The following new Section is added after Section 548.

SECTION 549

GEOSYNTHETIC REINFORCED SOIL ABUTMENTS & WALLS

549-1 Description.

Construct geosynthetic reinforced soil abutments & walls (GRS) in accordance with this Section and in conformance with the lines, grades, design, and dimensions shown in the Contract Documents or established by the Engineer.

Ensure that each shipment of products to the job site includes a signed or stamped delivery ticket in accordance with the Materials Manual, Section 8.2 Volume II, and the required written certification statement for each product shipped. Provide these tickets and certifications to the Engineer.

Store geosynthetics in conditions above 20°F and not greater than 140°F. Prevent mud, wet cement, epoxy, and like materials from coming into contact with and affixing to the geosynthetic material. Rolled geosynthetic may be laid flat or stood on end for storage. Cover the geosynthetic and protect from sunlight prior to placement.

Carefully inspect all reinforcement geosynthetics to ensure they are the proper size and free from defects that may impair their strength and durability.

549-2 Materials.

549-2.1 Masonry Facing Blocks: When 7-5/8 inch high concrete masonry units (CMU) are shown on the Plans, provide and install normal weight CMUs of the size, textures and colors as shown on the plans. Install textured facing blocks with textured face exposed. Install textured corner blocks in wall corners adjacent to textured blocks. When scour protection is shown in the plans, install only solid masonry blocks below the top of scour protection elevation as shown on the plans. Ensure all CMUs are manufactured in accordance with ASTM C 90 with a minimum 28 day compressive strength of 4000 psi and a water absorption limit of 5%.

When 8" high Facing Blocks are shown on the Plans, provide and install normal weight dry-cast segmental retaining wall units manufactured in accordance with ASTM C 1372 with a minimum 28 day compressive strength of 4000 psi and a water absorption limit of 5%. Ensure all segmental retaining wall units are nominally 8" high x 18" long x 11" minimum depth (front to back), weigh at least 75 pounds each, and are cast with only vertical voids. The length of blocks at corners may vary in order to achieve running bond pattern or corner geometry shown on the Plans.

Unless shown otherwise on the Plans, ensure blocks at skewed corners are either solid blocks trimmed in an appropriate manner to provide the required color and texture or two blocks joined together with reinforced concrete.

549-2.2 Reinforced Soil Foundation (RSF):

Segmental Block Walls

- ◆ Segmental Block MSE Walls (SBW)
 - ✓ Direct Substitution for MSE Walls with Reinforced Concrete Panel Facing
 - ✓ Same Wall Control Drawings (Shop Drawings req'd)
 - ✓ Developmental Specification 548
 - ✓ Lower Cost
 - ✓ Not a QPL item

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The screenshot shows the FDOT website with the following elements:

- Header:** FDOT logo, "Florida Department of TRANSPORTATION", "E-Updates | FL511 | Mobile | Site Map", and a search bar.
- Navigation:** Home, About FDOT, Contact Us, Maps & Data, Offices, Performance, Projects.
- Main Image:** A large bridge at sunset.
- Section: In the Blink of an Eye**

A recent documentary captures the story of the Mathews Bridge repair following a major collision with a ship. The emergency repairs to the Jacksonville landmark took place in late 2013. [More...](#)

1 2 3 4 5
- Travelers and Commuters**

511, SunPass, Road Conditions, Rest Areas, Service Plazas, More...
- Business and Government**

Bid Letting/Awards, Contracts, Permits, Planning, Programs, Specifications, More...
- Newsroom**

Media Contacts, News Releases, Photos, Social Media, Videos, More...
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 - Meetings
 - [Executive Meetings](#)
 - [Florida Administrative Register](#)
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 - Project Information**
 - [Active Projects](#)
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Office of Design

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Florida's Transportation Engineers

INVITATION TO INNOVATION



Recently, the Department embarked into a new bold era for innovative ideas, research and accelerated implementation. Success in this new era depends on the ability to innovate the products and services Florida's transportation system provides its users. The Florida Department of Transportation's desire for innovation will utilize newly developed technology or employ "outside the box" thinking to generate new and better value for every transportation dollar invested.

After researching and evaluating many innovative ideas, the Central Office has developed a list of concepts, products and services that may be the best solution to the project's needs or design challenges. Some items on the list are completely developed, and only need tailoring to your project. We encourage you to propose one or more of these innovations for project specific solutions with confidence of approval by the Districts. Other items are not fully detailed and will require coordination with and approval by the District's Design Office. Many of these innovations have been successfully implemented in other states and countries. Not all projects benefit from these innovations and the Department is not advocating the general use of new products or designs where an economical well proven solution exists and is the most appropriate solution for the situation.

Please consider these innovations as possible solutions to your project-specific needs. We invite you to review innovations listed in the links below. Additional innovations will be added as they are identified and developed. If you have any questions, details and contact information are included within the information for each innovation web site.

Structures Design Office

Prefabricated Bridge Elements and Systems
Curved Precast Spliced U-Girder Bridges
Geosynthetic Reinforced Soil Integrated Bridge System
Geosynthetic Reinforced Soil Wall
Segmental Block Walls

Engineering CADD Office

Coming Soon

Roadway Design Office

Roundabouts - Proven Safety Countermeasure
Diverging Diamond Interchange/Double Crossover Intersection


Surveying and Mapping Office

CADD/GIS Interoperability

QPL Office

Coming Soon

SBW - Invitation to Innovation

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Structures Design / Transportation Innovation

Segmental Block Walls (SBW)

Structures Design - Transportation Innovation

Segmental Block Walls (SBW)


[Overview](#)
[Design Criteria](#)
[Specifications](#)
[Implementation Plan](#)
[Usage Restrictions / Parameters](#)
[Contact](#)

Overview

Segmental Block Walls (SBWs) may be used as an alternative to most MSE walls, but not to support spread footings. The construction of SBWs is achievable without the use of heavy equipment or cranes. Interlocking CMUs are used to provide a mechanical connection of the geotextile reinforcement to the wall face.

The primary difference between SBW and GRS is the frequency of the reinforcement. SBW facing blocks may be used for [GRS Abutments](#) and [GRS Walls](#).

Photo Slideshow



Design Criteria

Follow the design criteria of MSE walls in accordance with the FDOT Structures Manual and the AASHTO LRFD Bridge Design Specifications, 6th Edition. The maximum geosynthetic vertical spacing is the lesser of two facing blocks in height or 30 inches. Provide a minimum horizontal distance between the edge of the travel lane and the wall equal to one-half of the wall height.

Specifications

Include [Developmental Specification 546](#) in the Specification Package when SBW are an allowed alternate on the project.

Implementation Plan

Segmental Block Walls are available for immediate implementation with authorization from SDO and concurrence from the District on limited projects.


Usage Restrictions / Parameters

SBWs may be considered for walls having heights up to 40 feet. When the wall face is within the clear zone of an adjacent roadway, the facing blocks must be solid from the bottom of the wall to 8 feet above the proposed grade.

Contact Information

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Segmental Block Walls (SBW)



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Photo Slideshow



SBW - Design

- ◆ Same Design as MSE Walls with Reinforced Concrete Panel Facing
- ◆ Geosynthetic Reinforcement
- ◆ Limiting Differential Settlement = $1/200$
- ◆ Reinforcement must attach to every, or every other, course of blocks
- ◆ Walls up to 40 feet high

SBW - Design Restrictions

- ◆ No Spread Footings
- ◆ Distance between the travel lane and the wall equal to one-half of the wall height or more (incl. shoulder)
- ◆ When the wall face is within the clear zone of an adjacent roadway, the facing blocks must be solid from the bottom of the wall to 8 feet above the proposed grade.

SBW - Plans Requirements

- ◆ Indicate on Wall Control Plans where Segmental Block MSE Walls may be used.
 - ✓ Currently SBW blocks require a 2° min. wall batter
 - ✓ Walls where 2° batter impacts offsets or ROW cannot be SBW

SBW - Plans Requirements

- ◆ Developmental Specification 548 in Specs Package
 - ✓ Request through District Specifications Office
 - ✓ PDF with Project ID will be provided.
 - ✓ DS548 includes Specs for both Panel & SBW MSE

Questions?

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